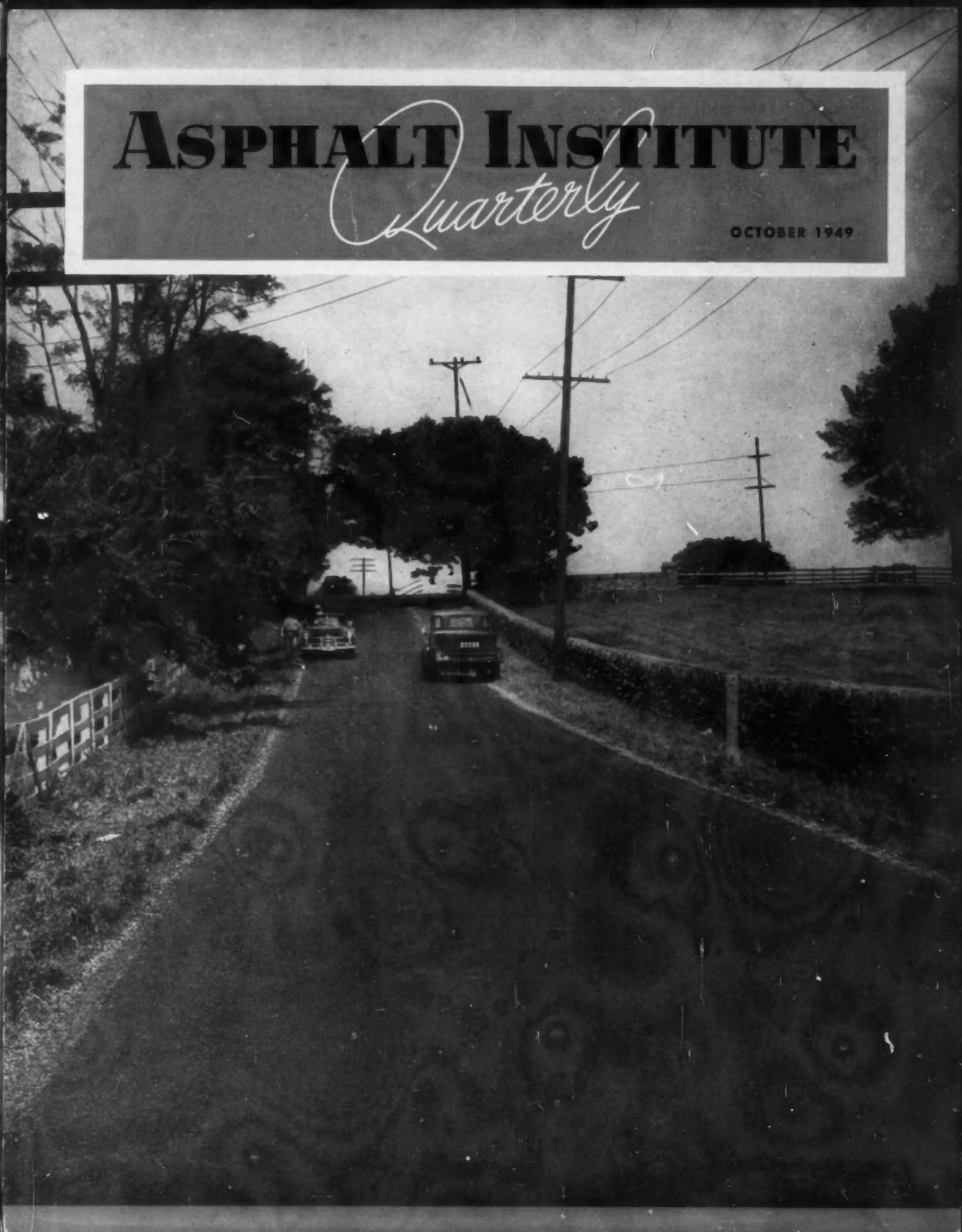
Asphalt Institute Quarterly

OCTOBER 1949



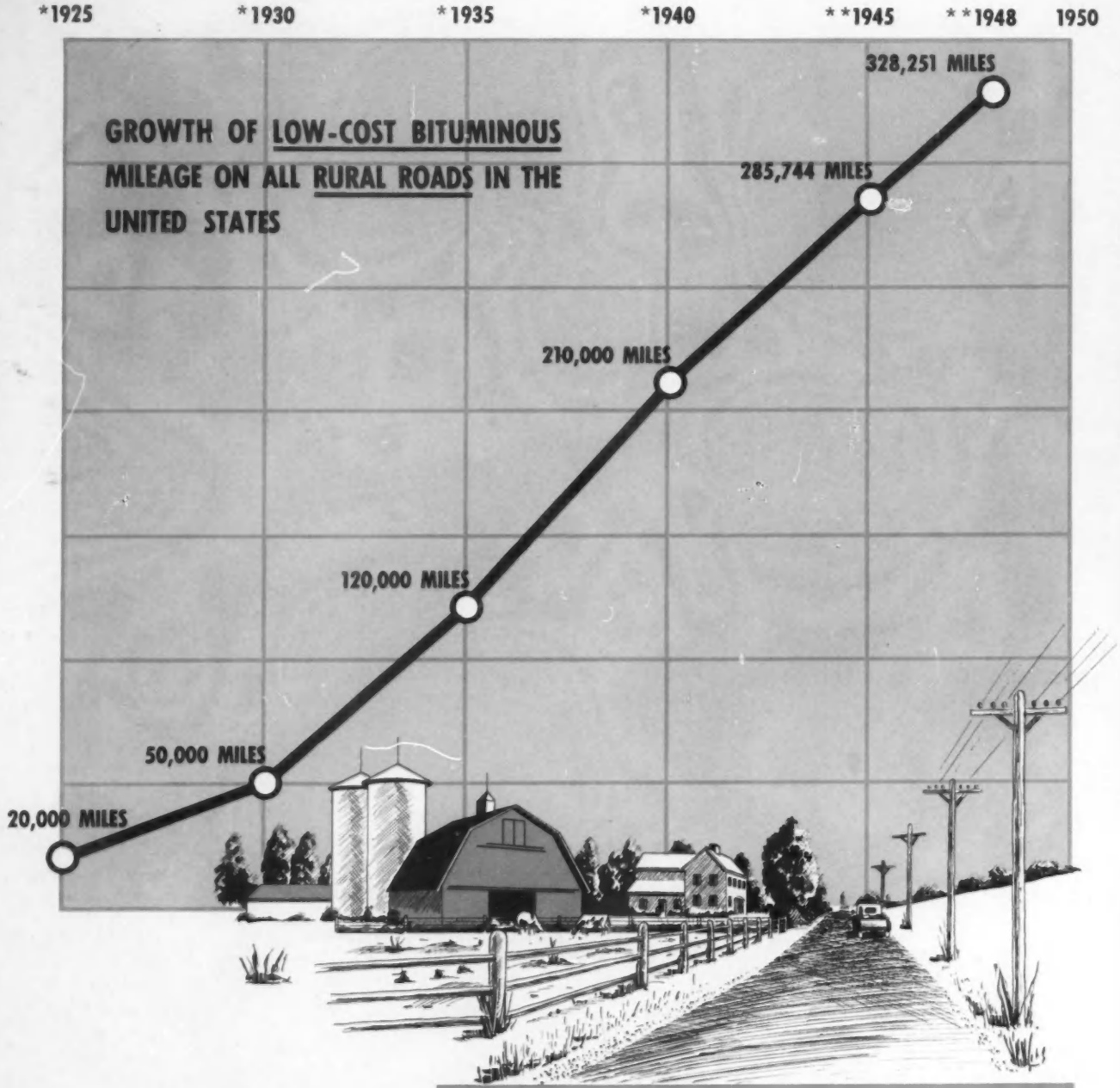


Chart of EXISTING Low-Cost Type Bituminous Mileage as of January 1st For each year shown

*ASPHALT INSTITUTE ESTIMATES

**FROM COMPLETE TABLES OF UNITED STATES PUBLIC ROADS ADMINISTRATION

Charted by The Asphalt Institute, September, 1949

ASPHALT INSTITUTE Quarterly

VOL. 1 No. 3 OCTOBER, 1949

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Articles may be freely reprinted with credit line. Correspondence should be addressed to the Asphalt Institute Quarterly, 801 Second Avenue, New York 17, N. Y.

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COVER

Featured on the cover is a typical secondary asphalt road in the Bluegrass region of Kentucky. Race horses on Blue Top Farm are shown at left (*on back cover*). Over this road war material was hauled for General Jackson at the Battle of New Orleans in 1815, but its *asphalt* history consists of surface treatments begun in 1913 and a road-mix type of resurfacing in 1937. It is in excellent condition today.

The graphic chart featured on the opposite page, a complement of the chart similarly placed in the July 1949 issue, illustrates the steady growth of *Low-Cost Types* of Bituminous mileage in the United States on state systems *and* all other rural roads. Of the entire paved highway system, *Bituminous* types now constitute over 80 percent of the mileage.

LOW-COST ROADS

The term "low-cost roads" usually is understood to mean secondary highways which carry light and medium traffic. The great majority of all roads are included in this category, and 25 per cent of all traffic moves over them. Total daily traffic per mile on these secondary roads seldom is as much as 1,000 vehicles, and on the greater part it is less than 50 vehicles, yet *farm trucks* constitute nearly 35 per cent of all trucks operated.

Many people have curious concepts about roads, especially the city dweller who sees little but crowded streets and parkways and thus thinks in terms of great traffic density. Actually, of the 3,000,000 miles of highways in the United States, *less than one per cent* carry as much as 2,000 vehicles per day; while about 1,800,000 miles have less than 50 vehicles per day. Inasmuch as a two-lane highway of proper cross section can carry from 500 to 800 vehicles per hour, it follows that the comparatively low-cost secondary road system is almost entirely a two-lane development. As a matter of fact, in many instances, the roads need be only sufficiently wide to permit passage of two vehicles at relatively low speeds.

The full development of adequate all-weather roads on the secondary system is of immense importance. A great aid to rural betterment would be easier year-round access to churches, schools, stores, and doctors, which would thereby assure to the farmer the same advantages now afforded to the urban resident. Provision of these modern necessities, in addition to the inherent advantages of country life, would tend to develop a better balance in the overall distribution of population, and would mitigate, in part at least, the complexities brought about by the present concentration in cities.

The low-cost road movement began in the twenties, and the 1926-27 sessions of the Highway Research Board were devoted in large part to the subject. In the early thirties, The American Farm Bureau Federation carried on a countrywide campaign to arouse the people to the necessity of such improvement, and in a single state, for example Pennsylvania, rural roads were improved at the high rate of 10,000 miles per year with the objective of reaching every farm with an all-weather highway.

Several other states have followed similar programs. The present problem is how to continue to build such roads at truly low cost, so that expenditures made upon the secondary system will be in proper balance with those required on the primary system.

Cities are utterly dependent upon the land for the very bread of life, and yet in turn the farmer, under present conditions, is similarly dependent upon the cities for the machinery, the clothing, the radios, and other manufactured products which have become so much a part of our present standard of living. It follows, therefore, that the continued development of low-cost secondary roads is vital to all.

DESIGNING LOW COST ROADS

WEST VIRGINIA'S U. S. 220, South Branch Valley, near Petersburg. Gravel sub-base, stone base, asphalt treated. Constructed about May 1926; photo May 1949.

There are two fundamentals of design which must be present in any well built road, whether it costs a million dollars a mile or less than a thousand. They are first, *drainage* and second, *proper foundation.* Without them, the best alignment and the easiest grades are of little avail. With them, a road can wind over hill and dale, and still give useful service every day of the year. Tolerances for curvature and grade, therefore, should be established for the kind and amount of traffic expected, and as the road use pattern has become quite well defined in most areas, it is not necessary today to anticipate the future very far ahead.

This point needs some emphasis, because there is a trend toward *unnecessarily high design standards,* particularly on some federal and state aid secondary roads, which can markedly affect costs without commensurate return. Of course, where low cost surfaces are placed on *primary* routes, the same attention to new right-of-way, surveys, and records is required as for high type pavements. For the distinctly local roads, however, a reasonable amount of right-of-way is already available, and usually it is possible so to modify the alignment within these limits as to meet all real needs.

In view of the fact that some two million miles of roads do not have now, or are unlikely to have, as much traffic as even 200 vehicles per mile per day, it can be seen readily that not only must the surfaces be at low cost, but all the incidental items proportionately low, if a well rounded improvement is to be attained.

SURVEYS AND PLANS

For the field work a three man survey party usually can run a satisfactory line by eye, with only such reference points and notes as will indicate drainage, buildings, fences and principal obstacles. Grade stakes can be set at 50-foot intervals at the time of the survey, and the necessary cross-sections taken. For the office work, a simple profile and cross-sections are usually suffi-

CONNECTICUT. Typical of hundreds of thousands of miles of rural roads is this untreated gravel road in Fairfield County.

cient. Record alignment plans are seldom needed for the very light traffic roads.

The new grade should be established involving minimum earthwork, *yet consistent with keeping the roadbed well above the water-table.* It is far better to roll the grade over a small hill and retain good drainage, than to make a cut for the sake of a nicer looking slope on paper, and later find a soft spot in the actual road. To fill the low sections, it is usually more desirable to borrow selected soil, than to try to balance cut and fill within the road limits. Every possible inherent load support value, brought about over the years, should be conserved and added to with new good material, rather than wastefully destroyed.

It is really astonishing what economies can be effected, provided non-essential standards for alignment and grade are not required; and yet over and over again we find surveys, plans and records being made for light traffic that would suffice for twenty times the volume. As a matter of fact, a rolling, winding road is usually not only easier to drain but also, as speeds are lower, safer for travel. Few people are killed or injured on secondary roads. After all, the objective is an all-weather surface, free from mud-holes, and not a speedway. Moreover it is to be remembered that most of these roads are rather short, and that within a few miles intersection is made with the primary system.

A recent visit to a number of roads, first improved in 1912 and following the methods outlined, indicates the soundness of this simplified approach to surveys and plans. Except for subsequent surface treatment, and in some instances mixed-in-place wearing courses, the original macadam and gravel foundations are unchanged from the original construction. To be sure, they are still light traffic roads but so are over two thirds of all the highways in the entire country.

LOW-COST MATERIALS

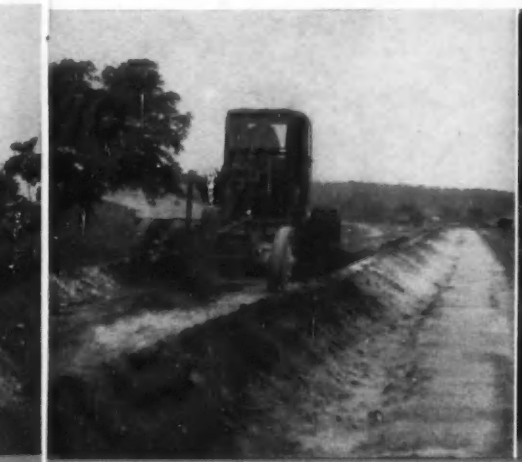
Low-cost roads of necessity must employ low-cost materials. That means materials from nearby points, particularly for foundations. Thus many aggregates used are local in character and even unknown by name a few hundred miles distant. There is the "red-dog" of Pennsylvania, the "caliche" of the southwest, the "limerock" of the southeast, the "shell" along the sea coasts, and the "talus" of the mountains, in addition to the more common sand, gravel, stone, and slag. Yet whatever they are, these aggregates should have a certain basic characeristic; namely, that when placed as foundations, bearing power shall be reduced little or none *by changing moisture conditions.* This is an easy matter to check, but one which is all too frequently neglected.

It is such a temptation to select an aggregate which will compact easily, that the damaging effect of too much clay binder is often overlooked, only to cause a lot of trouble later. By following standard methods of soil analysis, and using aggregate where the fine material does not show a Plasticity Index (P.I.) of more than 6, one can be quite sure that the foundation once compacted will remain that way. If the only abundant natural materials available have a P.I. higher than 6, then they should be modified, at least in the surface, through appropriate treatment, such as the addition of fine granular aggregate, treatment with lime, or stabilization with liquid asphaltic materials, until the resulting mixture is definitely reduced in P.I. below the danger point. Much research is being carried on in this field, and specifications for appropriate procedures are widely available.

There will always be a large mileage of local roads where surfacing cannot be justified beyond placement of such aggregate as will assure all-year support. When traffic reaches around 50 vehicles per day, however, further improvement becomes practicable, as the cost of maintenance, plus the loss of aggregate through wind and water erosion, usually amount to a sum sufficient to capitalize a mudless, dustless surface. Often this need be only a light oil dust layer, with the surface still maintained by blading, or it can be a substantial cold-laid plant-mix, if a sudden increase in traffic should make such improvement an economical development.

VERSATILE ASPHALT TYPES

Low cost asphalt surface types have been developed for every condition of soil, aggregate and traffic. An important property common to all, however, is the ability to become an *integral part* of any subsequent asphalt surface placed upon them. Thus a simple surface treatment may be strengthened by placement of an asphalt road-mix, then a cold-laid plant mix and finally, if needed, with hot-mix asphaltic concrete. This is a very important advantage which is making possible the rapid change from mud roads to all-weather pavements for, to paraphrase a well known trade slogan, and to adapt it to road fundamentals, once you have a good well-drained foundation, *if you save the surface, you save all.*



TEXAS — Adding lime to reduce plasticity of clay gravel.

VIRGINIA — The color and texture of surfaces can be secured through surface treatment with selected aggregate.

WYOMING — Typical mixed-in-place surface, approaching the Grand Tetons on U.S. 89 north of Jackson.

This series of eight illustrations shows some of the details considered important in heavy surface treatments to insure uniformity.

1 PLACING MACADAM BASE BY BLADING AND ROLLING WITH PNEUMATIC TIRED ROLLER.

2 ASPHALTIC MATERIAL BEING PUMPED FROM STORAGE TANKS *(RIGHT)* TO HEATER *(CENTER)* TO DISTRIBUTOR *(LEFT)*.

3 AFTER ROAD SURFACE IS PRIMED, SUCCESSIVE APPLICATIONS OF ASPHALT ARE STARTED ON PAPER TO AVOID OVERLAPPING.

4 PAPER THEN REMOVED AND SURFACE IS READY FOR COVER AGGREGATE.

CANADA — Surface Treatment in southern Ontario shows excellent texture and color to be obtained by skillful engineering control.

Surface Treatment Types

Surface treatments constitute the largest group of improved roads, making up 31% of the mileage on the *state* system alone, and 35% of *all* highways in the United States which are mudless and dustless throughout the year. Their importance is evident, and it is certain that these thin wearing courses always will be used, for not only are they low in first cost but are durable as well.

By definition, surface treatments are less than one inch in thickness, in fact most are not over one-half inch in depth. It is thus apparent that first, there must be some kind of a foundation to treat, and second, that the treatment be accomplished in a skillful manner to be uniform in bond, in texture, and in resistance to abrasion. It requires experience and careful attention to detail to insure these qualities, and probably there is no other kind of surfacing where such attention pays a higher return. In some States the work is so good, that double and triple treatments, sometimes called armorcoat or inverted penetration, are used on the main primary routes and yet require very little spot maintenance.

"LIFE EXPECTANCY"

How long will a surface treatment last? In view of misleading conclusions being drawn from a recent study on "Life Characteristics of Highway Surfaces," it is well to answer this question fully. Curiously enough it can be answered correctly in one of two ways, — either two to six years, or sixty to one hundred years. Why? The explanation is that surface treatments are maintained by surface treating, and experience has shown that the interval between subsequent treatments usually will range from two to six years. Is the pavement as a whole, however, worn out at the end of this interval? Obviously not, in fact usually it is even better because the weak spots have been strengthened and the entire road

5 COVER AGGREGATE IS STOCKPILED IN ADVANCE FOR QUICK TRANSFER TO TRUCKS AS WORK PROCEEDS.

6 COVER IS SPREAD MECHANICALLY TO INSURE EVEN, RAPID DISTRIBUTION.

7 LIGHT BLADING IS SOMETIMES DESIRABLE TO OVERCOME IRREGULARITIES BUT DOES NOT DISTURB AGGREGATE ALREADY BONDED.

8 FINAL ROLLING CONTINUES UNTIL AGGREGATE IS FIRMLY IMBEDDED IN ASPHALT.

consolidated to a greater degree in the meantime.

So actually, after each retreatment, the surface becomes stronger than before, and while the longest economic interval before surface renewal is desirable may be about six years, the composite road structure has a very long life indeed. There are thousands of miles of surfaced treated highways, originally constructed twenty to thirty years ago, which are better today than when first built, and that will be even better thirty years hence. Experienced engineers are fully aware of this fact, but the layman already has been misled by some of the news reports of this study, a misunderstanding which certainly was never intended by the authors.

CONSTRUCTION PROCEDURE

Surface treatments fall in two principal groups, according to the nature of the materials making up the foundation. They are: (1) tightly bonded aggregates, such as waterbound macadam, claybonded gravel, shale, limerock, caliche, etc., and (2) loosely bonded ones, such as traffic-bound macadam, sandy-gravel, cinders, shell, etc.

The majority of untreated surfaces will have from six to eight inches of aggregate, and the first item to be considered relates to the surface texture. If already tightly bonded, the asphalt primer should be very thin so as to penetrate well into the surface. If but loosely bonded, however, a somewhat heavier asphaltic material is needed for priming, together with some mixing to produce a tightly bonded condition.

The next item is the second application of asphalt, and here there is a wide choice, according to traffic, kind of cover aggregate available, and conditions under which work is to be done. For example, surface treatments should be accomplished early in summer so that several months' traffic will thoroughly knit asphalt and aggregate together before cold weather. If cover aggregate is dusty, it should be pretreated to insure immediate bond, especially if the road is open to fast traffic while treatment is being made. Such pre-treatment will save more in preventing "whip-off" of aggregate than it costs, to say nothing of more uniform results. However, work can be done in cold weather, provided cover aggregate is preheated to approximately 300° F., thus surely bonding with the asphalt film if the surface is rolled immediately.

These and many other details are set forth in Asphalt Institute Specifications shown on page 14. They are the result of nation-wide studies over a long period of years and take into account both developments in equipment and general technique. A good surface treatment is a good road, and merits the best engineering control.

PENNSYLVANIA — Macadam base and surface treatment on U.S. Route 522, near McConnelsburg.

CALIFORNIA — U.S. Route 99, surfaced with armor coat type. Mount Shasta in the distance.

These eight illustrations include views of both macadam aggregate and dense graded types, showing some essential details.

MINNESOTA — Mixed-in-Place surface on Route 61, south of Duluth.

Mixed-in-Place Types (ROAD-MIX)

This second largest group of low-cost asphalt surface types originated in the attempt to obtain greater thickness from a surface treatment by combination of repeated applications and dragging. Some of the early results were quite good and finally, through a process of trial and error, definite techniques began to emerge in different parts of the country which varied from one another largely by reason of the different aggregates and equipment available. Much of the specially manufactured machinery now available for mixed-in-place work evolved from agricultural equipment or road-graders, as modified in the maintenance shops of the state and county highway departments.

As mentioned in previous pages, a well constructed surface treatment is highly durable. However, it is only as smooth as the base upon which it is applied. Many of the early macadam and gravel roads while of good support were somewhat uneven, and the so-called drag treatment was developed in the attempt to fill the low places with the aggregate and asphalt removed from the high spots. While the road became smoother it also became less uniform in texture, as the aggregate-asphalt proportions varied according to the thickness of aggregate remaining in a particular place. Accordingly, in place of applying asphalt and covering with aggregate, the procedure was reversed, the aggregate first being placed to a uniform thickness, next penetrated with the asphalt, and then mixing accomplished by blade graders, long wheel-base drags, harrows of various kinds, all depending on the thickness and kind of aggregates employed.

CONSTRUCTION PROCEDURE

Gradually a definite pattern of construction procedure was developed for a particular aggregate and a particular set of climatic and traffic conditions. It was soon evident that richer mixtures were required for wet, cold climates than for dry, warm ones, also that various grades of asphaltic material were needed to meet the different construction conditions. In general, the slower the mixing processes, the longer the curing time required for the asphalt products, while of course the reverse is true. Sometimes this fact is overlooked, and highway departments call for a new kind of asphalt product, forgetting that the newer equipment accomplishes work much quicker, and consequently heavier standard products now may be employed than was formerly practicable.

For a particular kind of equipment, it is obvious that a longer time is required to coat fine sized aggregate than

1 PRIMING THE BASE WITH LIGHT ASPHALTIC MATERIAL APPLIED COLD.

2 AGGREGATE IS USUALLY SPREAD ONE-HALF ROADWAY WIDTH TO PERMIT PASSAGE OF TRAFFIC.

3 ASPHALT IS THEN APPLIED AND IMMEDIATELY MIXED USING VARIOUS TYPES EQUIPMENT SUCH AS SINGLE BLADE GRADERS.

4 MULTIPLE BLADE GRADERS ARE USED FREQUENTLY, WHICH ACCOMPLISH MIXING MORE RAPIDLY.

5 SOMETIMES COMBINATIONS OF SPECIAL MIXING EQUIPMENT AND BLADE GRADERS ARE USED.

6 AFTER MIXING IS COMPLETE AND THE MIXTURE IS ROLLED IN PLACE AN ASPHALT SEAL COAT IS APPLIED.

7 COVER AGGREGATE BEING APPLIED BY MECHANICAL SPREADER *(LEFT)* WITH RIGHT SIDE ALREADY COVERED.

8 THE SURFACE IS THEN ROLLED UNTIL THOROUGHLY COMPACTED.

coarse ones, and that also a lighter asphalt product is needed for fine aggregate. Experience in this regard has led to definition of mixed-in-place surfaces under two principal headings: (1) macadam aggregate type, and (2) dense graded aggregate type. While sand seems much finer than one-inch sized pieces of stone or gravel, it is actually the percentage of particles which will pass a 200-mesh sieve that really determines the amount and kind of asphaltic material which will produce the best results.

THICKNESS OF SURFACES

The thickness of mixed-in-place surfaces was originally controlled largely by the amount of aggregate that could be bladed with ordinary road graders. The maximum was about three inches and if greater thickness was desired, the mixing was accomplished in two layers. While present travel plants of various kinds can mix-in-place six inches depth and more in one pass, the great majority of work of this type is still done with blade graders, multi-blade grader equipment, and harrows. Also there is the economic limitation on thickness imposed by reason of costs of untreated base in relation to wearing surface. One other factor has a bearing and that is uniformity of thickness. Taking these factors all together it has worked out generally that a two-inch thickness is an economic one for macadam aggregate, and two and one-half to three inches is desirable for dense graded aggregate.

Mixed-in-place surfaces are very durable, and are particularly smooth riding because of the long wheel base equipment used in the finishing operations. Maintenance consists of periodic surface treatments, usually called seal-coating, and is simply a means of periodically waterproofing the surface and replacing the thickness worn away by traffic. While not as old a type as surface treatment, the fundamental principles are the same, and after each retreatment the road as a whole becomes stronger and hence has an *increasing* life expectancy, not a shorter one.

Above: VERMONT — Mixed-in-Place surface of macadam aggregate type on U.S. Route 7.

Below: WISCONSIN — Mixed-in-Place surface on Route 130, near Dodgeville.

MASSACHUSETTS — Cold-laid, sand asphalt mix surface, well adapted to sandy areas such as Cape Cod.

Cold-Laid Plant-Mix Types

Cold-laid plant-mix types are the result of two different developments and representative of the constant changes underway in the highway field as *new equipment* becomes available.

The first large use of cold-laid asphalt mixtures grew out of the desire to place asphaltic concrete in areas where asphalt plants were not available. Processes were invented whereby a mix could be made in a centrally located plant and then shipped, usually by rail, to points of use where it could be unloaded, placed, and compacted in the same manner as a regular hot-mix. By adjusting the components of the mix, the time of set could be modified to meet the needs of each situation. One of the best known of these cold-laid types was amiesite, named after the Dr. Amies who invented it. The aggregate was dried in the conventional manner and then allowed to cool before the mixing process. The delayed set was obtained by adding a light distillate, such as naphtha, to the dried aggregate before coating with asphalt. Until this distillate evaporated, the mixture remained flexible, and could be raked and spread, a week or more after manufacture.

Various other types were developed, some of which involved amalgamation of two or more constituents (such as powdered hard asphalt and flux) to produce the final asphaltic binder, a quite different process from evaporation of a distillate, but with the same objective. Types such as amiesite usually were open graded mixtures having a high per cent of voids so that the distillate could escape after the pavement had been compacted. With blends of powdered asphalt and flux, or soft asphalt cements, this was not so essential, hence both fine and coarse graded mixtures could be produced by such means.

Basic principles covering such work have become well understood and as most patents covering these various proprietary types have long since expired, specifications for each different process now are covered usually under a regular classification. For example, the amiesite type is given in Asphalt Institute specifications as simply CL-1.

The second category of use of cold-laid types is an outgrowth of mixed-in-place procedure, wherein a mixing plant has been substituted for the road-mixing with various kinds of harrows and blade graders. However, the mix usually is finished by road blading in the same manner as for mixed-in-place types. The delayed set which permits this procedure is obtained by using asphaltic products

The eight illustrations below show some of the equipment used during the past twenty years and also methods of placement.

1 SOUTHWEST—AN EARLIER TRAVEL-PLANT MIXER DEPOSITING DENSE GRADED, COLD-LAID, ASPHALT MIX PREPARATORY TO SPREADING BY BLADE-GRADERS.

2 MIDDLE ATLANTIC — BLADING A SAND ASPHALT COLD-LAID MIX FROM WINDROWS.

3 WEST — SPREADING A FINE-GRADED, COLD-LAID MIX WITH ONE OF THE EARLIER MECHANICAL SPREADERS.

4 SOUTH ATLANTIC — MODERN ASPHALT PLANTS OFTEN MANUFACTURE EITHER COLD-LAID OR HOT-LAID TYPE MIXTURES AS NEEDED.

FLORIDA — Cold-laid, sand asphalt mix, 5" thick, placed in two layers on sand base.

MONTANA — Cold-laid, denser graded type mix on U.S. Route 10 west of Billings.

such as cut-back or emulsified asphalts, or road oils, and as these products usually require aeration by blading to develop the asphalt binder, the grade of asphaltic product is selected according to the combined time required to accomplish mixing and spreading. It is obvious that if the mixing process, as in a plant, is shortened a more rapid setting asphalt product can be used, and the speed of construction thus expedited.

FACTORS AFFECTING CHOICE OF TYPE

There is, therefore, a well defined trend toward increased use of cold-laid plant mixtures in place of mixed-in-place work wherever jobs are of sufficient size to justify the needed equipment. Moreover, even on county and township roads, the rapidity with which plant mixtures can be placed is an important consideration, as the public becomes more and more accustomed to uninterrupted use of the highway system. One of the deciding factors in respect to choice between a mixed-in-place type and a cold-laid plant-mix, is condition of the untreated road surface. If already of sufficient thickness to support traffic, it may be economical to use the upper portion of aggregate already in place by mixing on the road with asphalt. On the other hand, where additional aggregate is required, it is usually both better and cheaper to pre-mix with asphalt before placement and consolidation on the roadbed.

PAVEMENT BETTERMENTS

In addition to such new construction and conversion of untreated surfaces, cold-laid plant mixtures are widely used for resurfacing of existing pavements, particularly as leveling courses, where spreading by means of a long wheel base blade grader makes smoothing the old pavement a simple and rapid procedure. Superelevating and widening curves is increasingly done with cold-laid mixtures, often well in advance of later surfacing with hot-mix asphalt surfaces, thus permitting traffic to aid in thorough consolidation of the leveling course.

Cold-laid plant mixtures also are used for patching, and betterment work such as shoulder widening as, in order to meet maintenance requirements, where small quantities only are used at one time, it is frequently necessary to have a stock pile of prepared mixture that will be usable over a considerable period.

Four principal varieties of cold-laid, plant-mix types are included on page 14, and full information thereon may be obtained from any Institute Office.

"LIFE EXPECTANCY" OF LOW-COST ROADS

Low-cost bituminous surfaces are the very back-bone of American highway systems. Replacement requirements are negligible. *Effective improvement* comes by stages as needed, largely through intelligent, skilful betterment operations, such as widening and thickening. For example, review the history of the road shown on this Quarterly's cover. A dirt road in 1815, paved with stone about 1880, surface-treated first in 1913, resurfaced by mixed-in-place methods 1937 and photo taken 1949. Life expectancy ??? — as long as needed for present traffic, then *100% salvage* under a new plant-mixed top, if and when traffic requires.

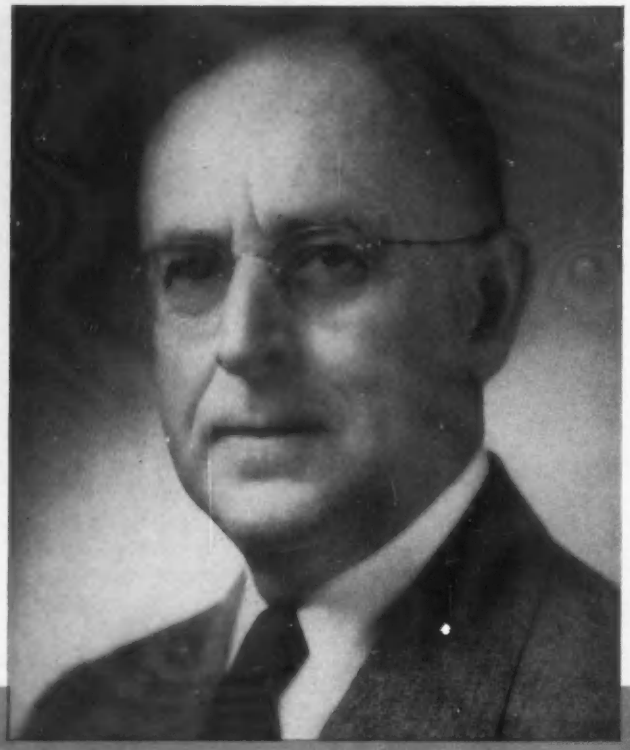
PAVE AND SAVE — WITH ASPHALT

5 CENTRAL — PLACING TACK-COAT OF EMULSIFIED ASPHALT AND LIGHT SAND COVER OVER OLD BLACK PAVEMENT PRIOR TO RESURFACING.

6 NORTH ATLANTIC—SPREADING COLD-LAID OPEN GRADED TYPE AS RESURFACING OVER OLD PAVEMENT, WHILE TRAFFIC USES OTHER HALF OF ROAD.

7 WEST — COLD-LAID PLANT-MIX USED TO WIDEN ROAD SHOULDER.

8 NORTH ATLANTIC — LEVELING COURSE OF COLD-LAID PLANT-MIX PLACED A YEAR IN ADVANCE OF RESURFACING TO WIDEN OLD ROAD AND REDUCE CROWN.



NORMAN H. ANGELL

President and Chairman of Executive Committee of The Asphalt Institute

Mr. Angell is serving as President and Chairman of the Executive Committee of the Asphalt Institute for 1949. In accordance with Institute practice, a representative from a member company in another division will hold these offices in 1950. Mr. Angell spent twenty-six years with the Asphalt Marketing Division of Standard Oil Company of California, and for the past year has served in his present capacity as Vice President in Charge of Sales of the Stancal Asphalt & Bitumuls Company. His briefly expressed views on the functions of the Asphalt Institute are presented herewith.

THE PLACE OF THE ASPHALT INSTITUTE

by Norman H. Angell

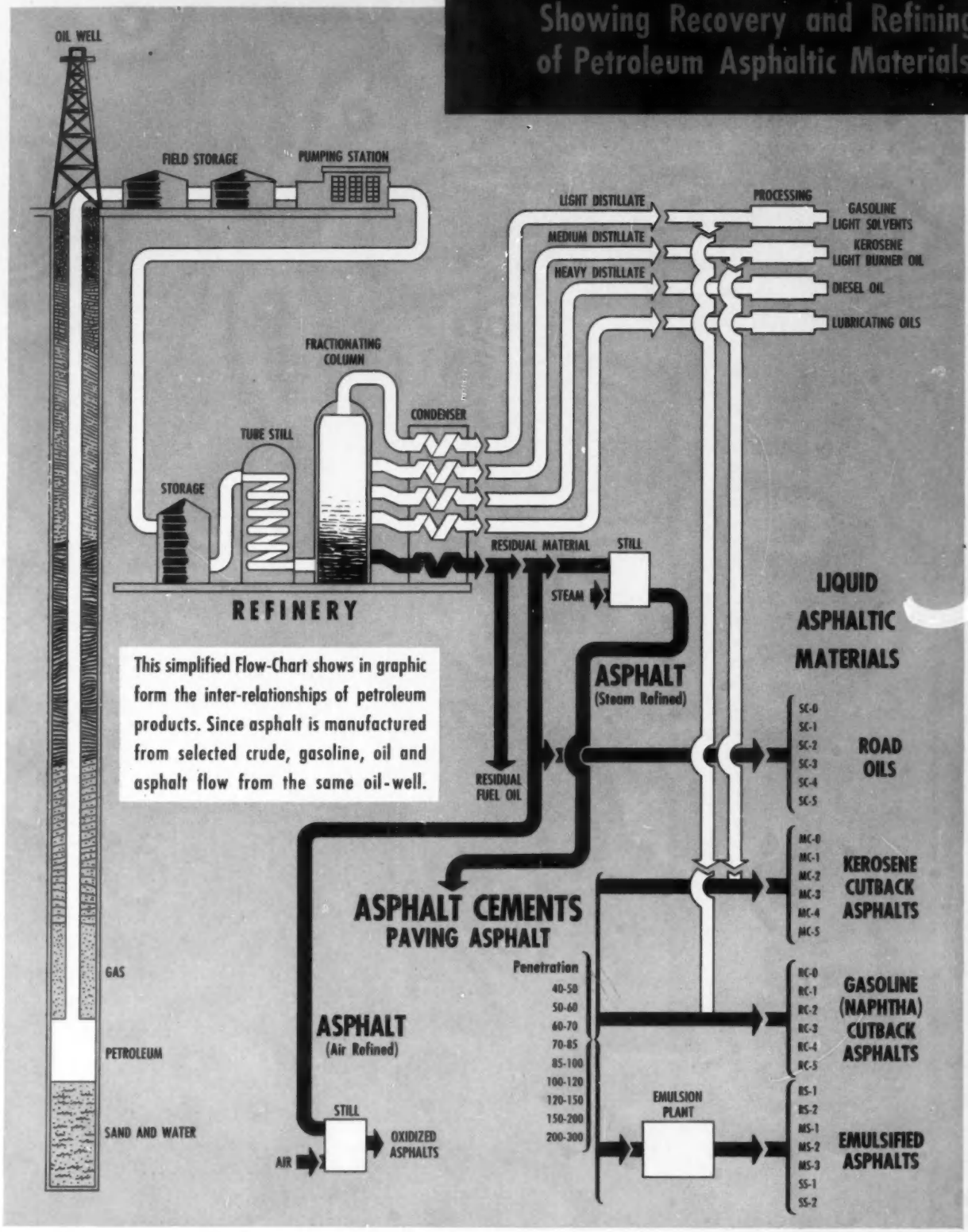
Companies sponsoring and supporting the Asphalt Institute do so because they are interested in selling asphalt and increasing the amount of such sales. We feel that the chief function of The Asphalt Institute is to keep abreast or ahead of good modern highway construction practices in order that we may be in a position to keep users continually informed as to the best manner in which asphalt can be used on their particular projects. This leads to employment of sound construction practices and efficient and economical use of highway funds, which in turn leads to increased use of asphaltic paving materials.

There is a proper type of asphalt surfacing for every road or highway, dependent upon soil and climatic conditions, availability of aggregate, wheel loads and traffic intensity. The Asphalt Institute, through its District Engineers, is in a position to suggest construction procedures which are compatible with local conditions and practices.

The strides made in the last few years in the proper design of asphaltic type pavements for a given set of conditions have given engineers added confidence in their use and have been reflected in increasingly widespread public approval of these types. Sound construction practices based on good engineering precepts prevent waste of the taxpayers' money and lead to more asphalt highway mileage.

The present organizational setup of the Institute, with six geographical Divisions, each with its own Management Committee and Engineering and Development Committee, working closely with local engineers on local problems and with the Head Office correlating all and issuing pertinent specifications and literature, is proving to be both progressive and effective. We feel that The Asphalt Institute is of mutual benefit to both producer and consumer.

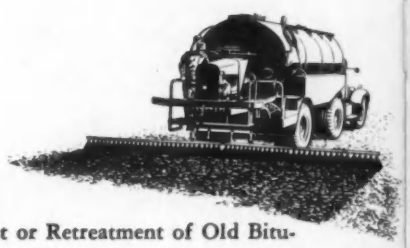
SIMPLIFIED FLOW CHART
Showing Recovery and Refining of Petroleum Asphaltic Materials



CONSTRUCTION SPECIFICATIONS OF THE ASPHALT INSTITUTE

The Construction Specifications of The Asphalt Institute provide broad, *general* standards of acceptable methods and materials for assuring completely satisfactory construction results. *Within these limits* engineers, public officials, and others engaged in highway and airport work may obtain full details as to design, construction procedure and maintenance from *Asphalt Institute Offices*. See list of addresses on opposite page.

For *Secondary Highways*—low-cost roads to carry light or medium traffic—the selection of type of asphalt construction should be made from the specifications listed below.



SURFACE TREATMENT

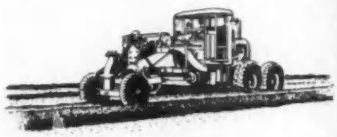
S-1——Asphalt Surface Treatment or Retreatment of Old Bituminous Surfaces.

S-2——Asphalt Surface Treatment of Tightly Bonded Surfaces.

S-3——Asphalt Surface Treatment of Loosely Bonded Surfaces.

S-4——Emulsified Asphalt Surface Treatment of Old Bituminous or Other Paved Surfaces.

S-5——Emulsified Asphalt Single and Double Surface Treatments of Tightly Bonded and Rough Texture Surfaces.



ROAD-MIX

RM-1— Mixed-in-Place Asphalt Surface Course (Macadam Aggregate Type).

RM-2— Mixed-in-Place Asphalt Surface Course (Dense Graded Aggregate Type).

RM-3— Sand-Asphalt Mixed-in-Place Course on Natural Sand Subgrade.

COLD-LAID PLANT-MIX

CL-1— Asphaltic Plant-Mix Surface Course (Cold-Laid Precoated Macadam Aggregate Type).

CL-2— Asphaltic Plant-Mix Surface Course (Cold-Laid Macadam Aggregate Type).

CL-3— Asphaltic Plant-Mix Surface Course (Cold-Laid Dense Graded Aggregate Type).

CL-4— Cold-Mix, Cold-Laid Emulsified Asphalt Plant-Mix Base and Surface Courses (Dense Graded Aggregate Type).

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